

The scolopendromorph centipedes (Chilopoda, Scolopendromorpha) of Tunisia: taxonomy, distribution and habitats

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Abstract

The present paper provides a review of the composition, distribution and habitat preferences of the scolopendromorph centipede fauna of Tunisia. Five (sub)genera and 8 (sub)species have hitherto been reported from the country, of which two are of uncertain status. After a study of significant amount of new material collected in the period 2003-2008, 6 species, namely *Scolopendra canidens* Newport, 1844, *S. morsitans* Linnaeus, 1758, *Cormocephalus gervaisianus* (C.L. Koch, 1841), *Otostigmus spinicaudus* (Newport, 1844), *Cryptops punicus* Silvestri, 1896 and *C. trisulcatus* Brölemann, 1902, were found in the country. New illustrations and, where appropriate, brief descriptions of the species are given, along with an identification key for the Tunisian scolopendromorphs. *Cryptops anomalans* Newport, 1844, *Scolopendra oraniensis* Lucas, 1846 and *S. cingulata* Latreille, 1829 are excluded from the country's list since all previous records are most likely based on misidentifications. *Cryptops trisulcatus* and *C. punicus* are recorded for the first time from Tunisia and Libya, respectively. The taxonomic position of *C. punicus* is discussed and the species is transferred from the subgenus *Trigonocryptops* to *Cryptops*. *Scolopendra morsitans scopoliiana* is synonymised under *S. morsitans*. *S. canidens*, *O. spinicaudus* and *C. punicus* are well adapted to arid and semidesert biotopes and have much wider ranges compared to the other three species which are restricted to the northern, more humid parts of the country. *S. canidens* is the only myriapod in Tunisia found in a pure sandy desert.

Keywords

Scolopendra, *Cormocephalus*, *Otostigmus*, *Cryptops*, deserts, oases, identification key, Tunisia, Libya

Introduction

The scolopendromorph centipedes of Tunisia have never been studied intensively. Prior to Silvestri's (1896) paper "Una escursione in Tunisia..." only two species, *Scolopendra oraniensis* Lucas, 1846 and *Scolopendra mediterranea* var. *africana* Verhoeff, 1891 collected in the cities of Tunis and Gabes respectively [misspelled Ghades], had been recorded from the country (Pocock 1892, Verhoeff, 1891, Verhoeff 1893). After studying topotypic material of the latter, Silvestri (1896) proposed its synonymy with *S. oraniensis*. In the same publication he also recorded *Cupipes* (now *Cormocephalus*) *gervaisianus* (C.L. Koch, 1841) and *Cryptops anomalans* Newport, 1844 for Tunisia, and described a new variety, *punicus*, of *C. anomalans*. Verhoeff (1901) described *Otostigma tunetanus* from Tunis which Kraepelin (1903) later synonymized with *Otostigma spinicaudus* (Newport, 1844). Kraepelin also reported *S. morsitans scopoliana* C.L. Koch, 1841 and *S. canidens* Newport, 1844, although he did not specify where exactly these species were collected. He disregarded the separate status of *punicus*. Attems (1902) reported *Scolopendra morsitans* Linnaeus, 1758 from Medjez-el-Bab in North Tunisia. A few years later, he (Attems 1908) also identified the myriapods amassed by Henri Gadeau de Kerville during his remarkable expedition to Kroumirie (NW Tunisia), confirming the occurrence in the area of *C. gervaisianus* and *C. anomalans*. Brölemann (1904) reported *Scolopendra morsitans* and *S. canidens* from several localities in Tunisia and was the first to summarize the information on the Myriapoda of North Africa, providing a checklist of all species known at that time (Brölemann 1921). He mentioned altogether 9 (sub)species of Scolopendromorpha for Tunisia, including *Scolopendra cingulata* Latreille, 1829, although, like Kraepelin, he did not mention any specific localities. In another paper (Brölemann 1928) he raised *Cryptops anomalans punicus* to full species rank and transferred it to the genus *Trigonocryptops* Verhoeff, 1906. In his monograph on Scolopendromorpha Attems (1930) excluded *S. oraniensis* and *S. cingulata* from the list of Tunisian species and probably being unaware of Brölemann's publication, regarded *C. punicus* as a synonym of *C. anomalans*. Studying a small collection of myriapods collected by Dr. Cloudsley-Thompson in Tunisia, Turk (1955) recorded *S. canidens* and *S. clavipes* C.L. Koch, 1847 from Jebel Cherchera, west of Kairouan. The same material was later referred to by Cloudsley-Thompson (1956). Dobroruka (1968) reported *S. morsitans*, *S. canidens* (incl. *S. c. cyrenaica* Verhoeff, 1908), and *C. gervaisianus* from several localities in Tunisia. Lewis (1969) recorded *Scolopendra amazonica* Bücherl, 1946, which is currently considered a junior synonym of *S. morsitans* (Würmli 1975, Koch 1983), from a mountain near Soukahas, Tunis, at 1000-1500 m elevation. This record from 1894 may refer to the Barbary state of Tunis rather than the city. This seems probable as there is no settlement with this name near Tunis, nor a mountain that high.

The taxonomic status and the distribution in the Mediterranean region of the species of *S. canidens* group were revised by Würmli (1980). Two of the subspecies, *S. canidens oraniensis* and *S. canidens cretica* Attems, 1902, were given full species rank, while some others including *S. c. cyrenaica* were synonymized. The author concluded

that in Tunisia the group, which comprises also *S. clavipes* and *S. dalmatica* C.L. Koch, 1847, is represented only by *S. canidens*. Recently, Zapparoli (2002), Zapparoli et al. (2004), Simaiakis and Mylonas (2008) mentioned Tunisia in their overviews of the world range of *Scolopendra cingulata*. The centipede fauna of the Italian islands Lampedusa, Linosa and Pantelleria, which are situated close to Tunisian coast, was studied by Zapparoli (1995). On Pantelleria, which is located approx. 70 km off the Tunisian coast he recorded *C. punicus*, *C. trisulcatus* Brölemann, 1902, and *S. cingulata*, while on the Pelagic islands Lampedusa and Linosa lying ca. 120 km off the coast *S. canidens* and *C. punicus* were found. CHILOBASE, the world catalogue of Chilopoda (Minelli 2006) lists the following taxa: *C. anomalans*, *C. punicus*, *C. gervaisianus*, *S. oraniensis* and *O. spinicaudus* for Tunisia.

The Tunisian scolopendromorph fauna comprises 5 (sub)genera and 8 (sub)species, of which, the occurrence of *S. cingulata* and *C. anomalans* needs confirmation. Almost all the remaining species are known from single outdated records, mainly from the northern, generally better prospected parts of the country (e.g. Kroumirie and Mogods regions). The scolopendromorph fauna of the arid, semidesert and desert regions in the central and southern parts of the country (e.g. the Tunisian Ridge, the Sahel, the plain of Kasserine, the Grand Erg Oriental and the coastal plain of Jeffara) remained virtually unknown as had the biology and ecology of all Tunisian species.

In the last five years abundant material of Scolopendromorpha collected in each of the four main bioclimatic zones of the country: Humid (Kroumirie and Mogods regions), Subhumid (Cap Bon Peninsula), Semiarid–Arid (Central Tunisia), Arid (meridian Tunisia, south of 36th parallel) was accumulated and investigated. The aim of present paper is to put on record the results of the identification of this significant collection and to provide detailed information on the taxonomy, distribution, habitats and in some cases also the biology of scolopendromorphs in Tunisia. New illustrations based on the freshly collected material and a key are provided to facilitate the identification of the species.

Material and methods

Unless stated otherwise, the material treated herein has been collected by N.A. and P.S. during a month long collecting trip in Tunisia conducted in March 2008, and also in the course of individual excursions by the first author to different regions of the country in the period 2003–2008. Various types of habitats were prospected for scolopendromorphs: oak forests (*Quercus suber*, *Q. faginea*, *Q. ilex*), pine forest (*Pinus halepensis*), open habitats dominated by *Stipa tenacissima*, arid rocky planes with scattered palm trees, pure sandy and rocky deserts, coastal and mountainous oases dominated by palm trees (*Phoenix dactylifera*), etc. All the material was preserved in 70 or 96 % ethanol and was shared between the Field Museum of Natural History, Chicago, National Museum of Natural History, Sofia and University of Tunis El Manar. Close up photos were taken under an Olympus SZH 10 research microscope with an Olym-

pus Altra-20 colour camera, and were processed using the program Adobe Photoshop CS2. A complete chronological list of citations related to species occurrence in Tunisia is also provided. Morphological terminology follows Lewis et al. (2005).

Abbreviations: ad. = adult, alt. = altitude, Distr. = District, ex. = exemplar/s, juv. = juvenile, N.P. = National Park, subad. = subadult.

Species account

Order Scolopendromorpha

Family Scolopendridae

Scolopendra canidens Newport, 1844

Figs 1-7

Scolopendra dalmatica var. *africana* Verhoeff, 1891, Berliner entomologische Zeitschrift, 36: 69.

Scolopendra mediterranea var. *africana*: Verhoeff 1893, Berliner entomologische Zeitschrift, 38: 319, fig. a.

Scolopendra oraniensis: Pocock 1892, Proceedings of the Zoological Society of London: 25.

Scolopendra oraniensis: Silvestri 1896, Naturalista Siciliano, An. I, (Nuova Serie), 8: 150.

Scolopendra canidens: Kraepelin 1903, Mitteilungen aus dem Naturhistorischen Museum in Hamburg, 20: 248, fig. 157.

Scolopendra canidens and *S. oraniensis*: Brölemann 1904, Bulletin du Muséum d'Histoire Naturelle 6: 318.

Scolopendra canidens and *S. oraniensis*: Brolemann 1921, Bulletin de la Société des Sciences Naturelles du Maroc, I (3-6): 104-105.

Scolopendra canidens canidens: Attems 1930, Das Tierreich, 54: 36.

Scolopendra canidens and *S. canidens oraniensis*: Brolemann 1932, Bulletin de la Société d'Histoire Naturelle d'Afrique du Nord, 23 (2): 52.

Scolopendra canidens canidens and *S. clavipes*: Turk 1955, Annals and Magazine of Natural History, ser. 12, vol. 8: 281.

Scolopendra canidens canidens and *S. clavipes*: Cloudsley-Thompson 1956, Annals and Magazine of Natural History, ser. 12, vol. 9: 328.

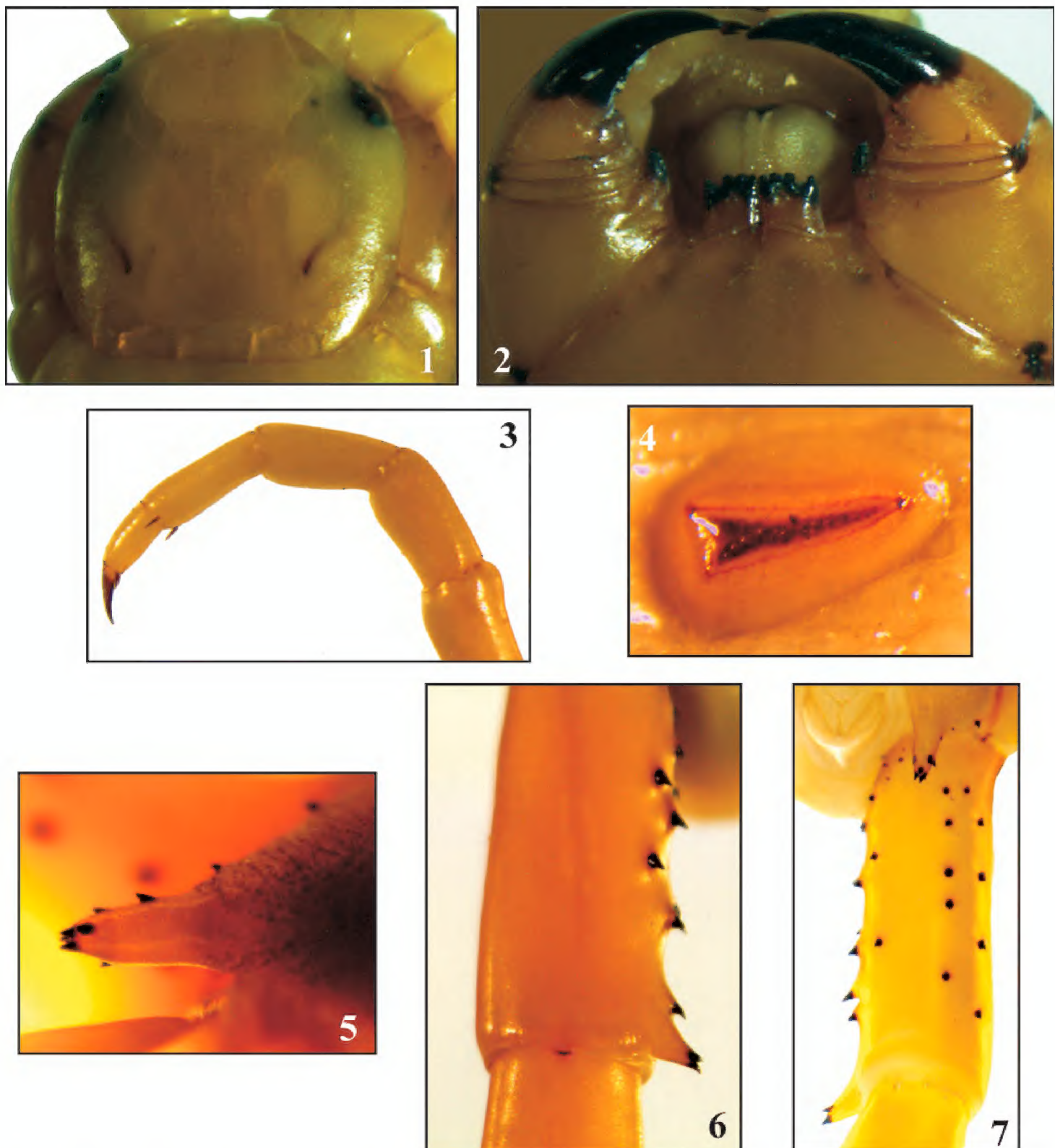
Scolopendra canidens canidens and *S. canidens cyrenaica*: Dobroruka 1968, Revue de Zoologie et de Botanique Africaines 78(3-4): 203.

Scolopendra canidens: Würmli 1980, Sitzungsberichte der Österreichischen Akademie der Wissenschaften, 189: 346, Abb. 10, 26.

Scolopendra canidens: Lewis 1985, Bijdragen tot de Dierkunde, 55 (1): 128, fig. 11, map 2.

Material examined. 1 juv., Sousse, N35°49.57/ E10°38.19, alt. 11 m, 17.2.2004; 1 ad., same locality, 22.3.2004; 1 juv., Le Kef, N36°11.44/ E08°44.39, alt. 623 m, 24.10.2003; 2 ex., Sfax, Agareb Steppe, N34°44.13/ E10°32.15, alt. 68 m, olive orchard, under stones, 25.11.2003; 1 juv., Mahdia Distr., Bekalta, N35°37.06/ E11°00.44, alt. 12 m, border of agricultural land, under stones, 30.10.2003; 1 ad., 3 juv., Sousse

Distr., Sidi Khalifa, N36°15.18/ E10°26.48, alt. 1 m, open area, 17.2.2004; 2 ex., Monastir, N35°46.43/ E10°49.48, alt. 6 m, 22.12.2004; 1 ex., Sousse Distr., Bou Ficha, N36°17.55/ E10°27.30, alt. 6 m, 22.3.2005; 1 ex., Hergla, N36°01.53/ E10°30.37, alt. 3 m, coast, 23.3.2005; 2 ad., 2 subad., Sidi Bouzid Distr., Bou Hedma N.P., N34°30.28/ E09°35.46, alt. 574 m, semi dry area dominated by *Acacia raddiana*, 20.3.2006; 1 subad., Nabeul Distr., Korba, N36°34.36/ E10°51.02, alt. 3 m, coast, 12.11.2006; 12 ex., Sfax Distr., Kerkennah Island, Chargui, N34°42.34/ E11°09.14, alt. 3 m, sandy open area, with scattered palm trees, under stones, 20.3.2007; 2 ad., Kebili, Fatnassa Oasis, May 2007; 1 ad., Zaouit El Hareth Oasis, 20.5.2007; 1 ad., Makthar, 12.5.2005; 2 juv.,



Figs 1-7. *Scolopendra canidens*: 1 – head plate; 2 – forcipular coxosternum and forcipules; 3 – leg 1; 4 – spiracle; 5 – coxopleural process, lateral view; 6-7 – prefemur of ultimate leg, dorsal and ventral views, respectively.

Kairouan Distr., Oueslatia, Aouinettes, 3.3.2005; 1 ex., Djerba Island, N33°52.09/ E10°50.42, alt. 10 m, 10.7.2003; 1 ex., Bizerta Distr., Ichkeul N.P., N37°09/ E9°5, maquis with *Olea europaea*, *Pistacia lentiscus* and *Smilax aspersa*, 8.2.2004; 6 juv., Kairouan Distr., 6 km of Oueslatia, N35°51.785/ E09°30.972, alt. 581 m, sparse olive trees, Roman ruins, bush, open area, stone debris, under stones, 6.3.2008; 1 ad., 1 juv., Sbeitla, 30 km NW Kasserine, inside the ruins of the ancient Roman town of Sifetoula, under stones, 7.3.2008; 4 ex., Kasserine Distr., Chambi N.P., surrounding of the park's guest house, N35°10.139/ E08°40.486, alt. 950 m, sparse trees, bush, *Pinus halepensis*, under stones, 7.3.2008; 1 ad., 3 juv., same locality, alt. 950-1000 m, *Pinus halepensis*, *Stipa tenacissima*, *Thuya*, under stones, logs and leaf litter of *Pinus halepensis*, 8.3.2008; 1 juv., inside Chambi N.P., N35°11.901/ E08°39.505, alt. 1291 m, *Pinus halepensis*, *Quercus ilex*, *Stipa tenacissima*, slope, under stones and leaf litter, 9.3.2008; 1 ad., Chambi peak and its surroundings, N35°12.285/ E08°40.653, alt. 1500-1540 m, *Pinus halepensis*, *Quercus ilex*, *Stipa tenacissima*, under stones and leaf litter, 9.3.2008; 1 ad., 1 juv., Gafsa Distr., Jebel Bou Ramli, N34°30.877/ E08°39.731, alt. 512 m, deserted rocky plain at the foot of the mountain, scattered trees, *Opuntia* and palm trees, under stones, 10.3.2008; 1 ad., Kebili Distr., Tombar, 6 km of Kebili, N33°43.463/ E08°54.349, alt. 14 m, oasis, palm trees, under stones, 12.3.2008; 2 ad., Kebili Distr., 10-20 km of Douz towards Matmata, N33°27.647/ E09°11.466, alt. 92, pure desert, sand, under stones, 12.3.2008; 5 ad., 3 juv., Gabes Distr., Matmata, N33°32.450/ E09°59.054, alt. 384 m, arid biotope, shrubs and stones, under stones, 12.3.2008; 2 ad., 1 juv., Gabes Distr., Matmata, N33°32.450/ E09°59.055, alt. 384 m, arid biotope, shrubs and stones, under stones, 13.3.2008; 2 ad., Tataouine Distr., surroundings of Tataouine city, N32°55.506/ E10°26.913, alt. 293 m, arid biotope, slope, stones, scattered trees of *Pinus* (planted), under stones, 13.3.2008; 3 ad., same district, Ksar Ouled Soltane, N32°47.281/ E10°30.784, alt. 453 m, arid biotope, rocks, stones, close to the village, under stones, 14.3.2008; 1 ad., Tataouine Distr., between Chenini and Douiret (mainly around Douiret), N32°51.090/ E10°16.900, alt. 425 m, arid biotope, close to the road, under stones, 14.3.2008; 1 juv., Mahdia Distr., Chebba (37 km south of Mahdia), N35°12.865/ E11°06.344, alt. 2 m, polluted suburban area close to the beach, under stones, 15.3.2008; 5 ad., Mahdia Distr., Mahdia City, Touristic area, N35°32.796/ E11°01.662, alt. 0 m, scattered palm trees and shrubs close to the road, polluted area not far from agricultural land, under stones, 16.3.2008; 1 ad., same locality, beach, sand, approx. 50-80 m from the water line, under stones, 16.3.2008; 4 ad., 2 juv., same district, surroundings of Ksour Essef (17 km of Mahdia), N35°24.824/ E10°58.026, alt. 59 m, olive trees (*Olea europaea*), grass, stones and shrubs, under stones, 16.3.2008; 2 ad., 3 juv., Siliana Distr., Jebel Bargou, 5 km of Bargou (road Bargou – Oueslatia), N36°05.775/ E09°37.347, alt. 571 m, *Quercus*, *Olea*, shrubs, under stones, 28.3.2008; 1 ad., 3 juv., same mountain, 50 km of Oueslatia (road Bargou – Oueslatia), N36°06.941/ E09°39.392, alt. 512 m, sparse olive trees, rocks, under stones, 28.3.2008; 8 ad., 6 juv., Zaghouan Distr., Jebel Mansour, close to Sidi Aouidet village, N36°12.307/ E09°45.588, alt. 514 m, Pine forest, *Rosmarinus*, under stones and leaf litter, 28.3.2008.

General distribution. Caucasus (Armenia, Azerbaijan), Italy (Lampedusa Island), Greece (Milos, Sifnos, Serifos, Gavdos?, Symi, Kastelorizo islands) Morocco, Algeria, Tunisia, Libya, Egypt, Turkey, Israel, Jordan, Lebanon, Syria, Iran, Saudi Arabia, Yemen, Turkmenistan, Uzbekistan, Tajikistan, Kazakhstan (Würlmli 1980, Negrea 1997, Lewis and Wranik 1990, Simaiakis and Mylonas 2008).

Distribution in Tunisia (Map 1). A widespread and much more common species than *S. morsitans*, in particular in central and southern Tunisia. In the North it is known only from Korba on the Cap Bon Peninsula. In the central and southern regions of the country it occurs in the High tell (hills of Le Kef), virtually along the whole Tunisian Ridge (from Chambi to Zaghoun mountains), the eastern lowland plain (the so called Sahel) and the plain of Jeffara (Matmata Mts., Tataouine region), the islands Djerba and Kerkennah. In the West it is found from the High Steppes (Gafsa Mts.) down to the Sahara boundaries (Oriental Erg). In the past the species has been reported also from Adjel el Haïoum, Arad, Sfax, Savoual, Makuassy, B. el Aalia, Jebel Cherchera, Gabes, Gabes-Mensel, Oasis Gafsa, Kairouan and Tunis (Verhoeff 1891, Pocock 1892, Silvestri 1896, Brölemann 1904, Turk 1955, Dobroruka 1968, Würlmli 1980). We were unable to find some of the localities, e.g. Adjel el Haïoum, Arad, Savoual, Makuassy, B. el Aalia, Gabes-Mensel, and they are not marked on the map.

Altitudinal range in Tunisia. From sea level up to 1500 m in the mountains (surroundings of Chambi Peak). In Saudi Arabia it is reported up to 2400 m alt. (Lewis 1986).

Habitats. Oak forests dominated by *Quercus ilex* or *Q. coccifera*; coniferous forests of *Pinus halepensis*; heterogeneous woods with *Q. ilex* and *P. halepensis*; semidry areas dominated by *Acacia raddiana*; coastal areas with sparse shrubs and semihumid grasslands; maquis with *Olea europaea*, *Pistacia lentiscus*; dry grasslands; dry rocky hills; sandy deserts; suburban areas; agricultural lands; *Olea europaea* stands; oases dominated by *Phoenix dactylifera*.

Remarks. The morphology of the specimens examined corresponds well to the species' description given by Attems (1930), Würlmli (1980), Lewis (1986), Zaleskaja and Schileyko (1991). All records of the closely related *S. oraniensis* and *S. clavipes* from Tunisia (e.g. Pocock 1892, Silvestri 1896, Turk 1955) are erroneous and should be attributed to this species. While there are no reliable records of the latter in North Africa at all, *S. oraniensis* is known from few localities in Algeria and Morocco, as well as from the Maltese Archipelago (Würlmli 1980, Zapparoli et al. 2004) and its occurrence in Tunisia is not improbable.

***Scolopendra morsitans* Linnaeus, 1758**

Figs 8-13

Scolopendra morsitans: Attems 1902, Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften in Wien, Mathematisch-Naturwissenschaftliche Classe 111 (I): 561.

Scolopendra morsitans scopoliana: Kraepelin 1903, Mitteilungen aus dem Naturhistorischen Museum in Hamburg, 20: 253.

Scolopendra morsitans and *S. morsitans scopoliana*: Brölemann 1904, Bulletin du Muséum d'Histoire Naturelle 6: 320-321.

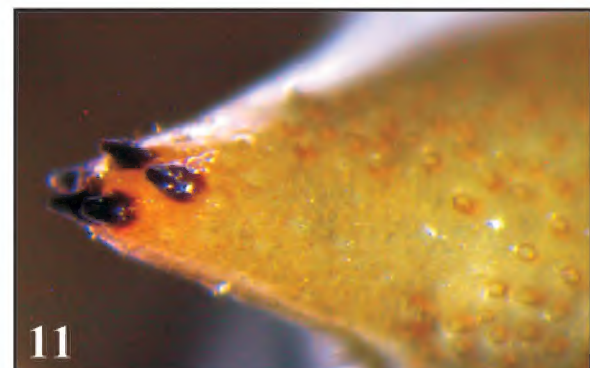
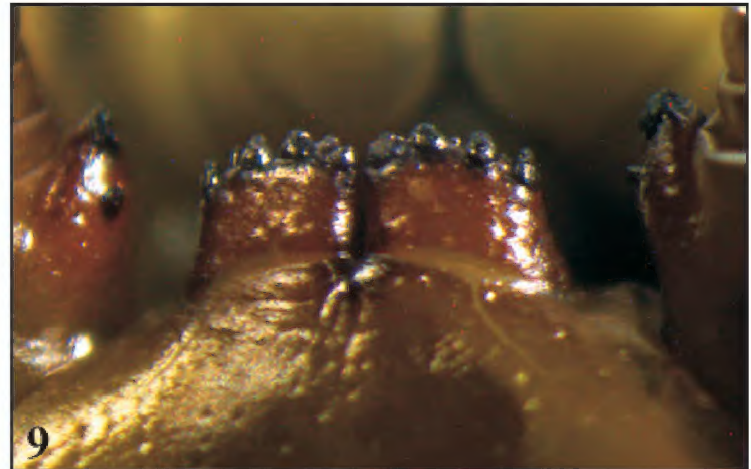
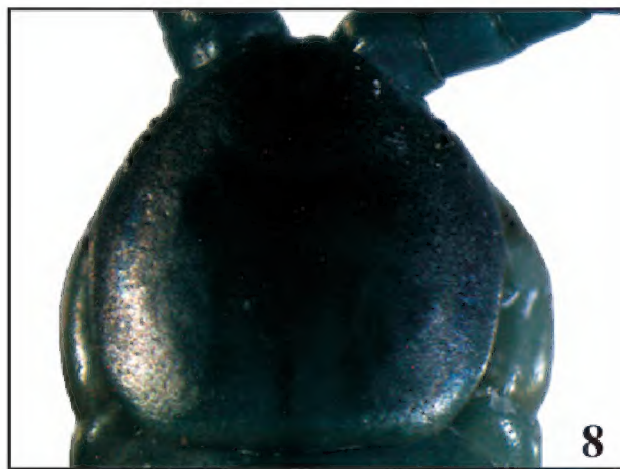
Scolopendra morsitans and *S. morsitans scopoliana*: Brolemann 1921, Bulletin de la Société des Sciences Naturelles du Maroc, I (3-6): 104.

Scolopendra morsitans and *S. morsitans scopoliana*: Attems 1930, Das Tierreich, 54: 23-25, figs 38-39.

Scolopendra morsitans and *S. morsitans scopoliana*: Brolemann 1932, Bulletin de la Société d'Histoire Naturelle d'Afrique du Nord, 23 (2): 51-52.

Scolopendra morsitans: Dobroruka 1968, Revue de Zoologie et de Botanique Africaines 78(3-4): 203.

Scolopendra amazonica: Lewis 1969, Zoological Journal of the Linnaean Society, 48 (1): 49-57.



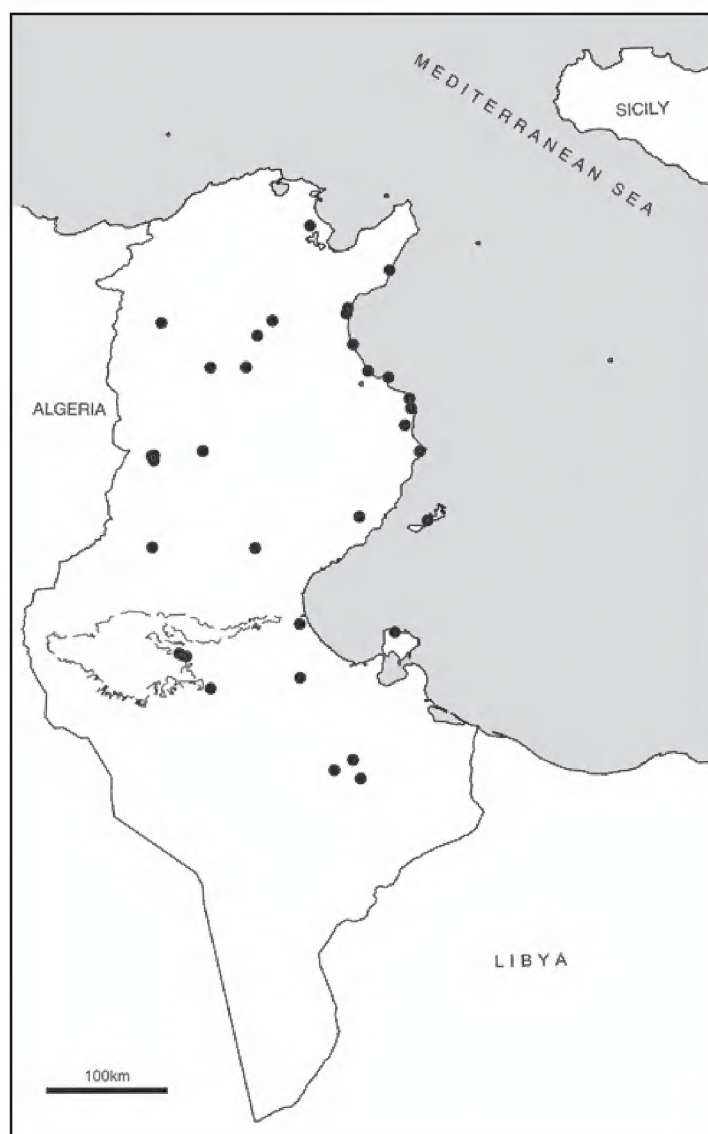
Figs 8-13. *Scolopendra morsitans*: 8 – head plate; 9 – forcipular coxosternal toothplate and trochanteroprefemoral process; 10 – leg 1; 11 – coxopleural process, ventral view; 12-13 – prefemur of ultimate leg, dorsal and ventral views, respectively.

Material examined. 2 ex., Nabeul Distr., Jebel Abderrahman, N36°41.31/ E10°40.20, alt. 168 m, garrigue with *Cistus monspeliensis*, *Pistacia lentiscus*, *Lavandula* sp., 24-28.11.2004; 1 ad., Siliana, N36°05.17/ E09°21.53, alt. 427 m, 7.6.2005; 1 ex., Zaghouan Distr., Jebel El Oust, N36°33.32/ E10°03.38, alt. 75 m, March 2006; 1 juv., Zaghouan Distr., Jebel El Fahs, N36°22.39/ E09°53.41, alt. 172 m, 20.3.2006; 1 ad., Cap Bon Peninsula, Nabeul Distr., El Haouaria, the ancient Roman quarry and surroundings, N37°03.448/ E10°59.869, alt. 51 m, slope facing the sea, under stones, 24.3.2008.

General distribution. North America (USA, Mexico); Caribbean Islands; South America; Atlantic Ocean Islands; Europe; Africa; Arabian Peninsula; Southeast Asia (incl. Indonesia, New Guinea, Philippines, Taiwan, and Japan); Indian Ocean Islands (Comoro Islands, Madagascar, Mascarene Islands, Seychelles); India; Australia; New Zealand; Pacific Islands (for more detailed information, see Shelley et al. 2005).

Distribution in Tunisia (Map 2). Known from the Subhumid and Semiarid bioclimatic zones. Comparatively rare species, found in northeastern Tunisia only – Cap Bon Peninsula, Jebel Zaghouan, Jebel El Fahs and near Siliana. The species has been reported also from Medjez-el-Bab (Attems 1902), Tunis and its surroundings (Brölemann 1904) and Jebel Serdj (Dobroruka 1968).

Altitudinal range in Tunisia. Known from sea level up to approx. 600 m.



Map 1. Distribution of *S. canidens* in Tunisia.



Map 2. Distribution of *S. morsitans* in Tunisia.

Habitats. Coniferous forests dominated by *P. halepensis*, mixed woods of *Q. coccifera* and *Rosmarinus officinalis*; garrigue with *Cistus monspeliensis*, *Pistacia lentiscus*, *Lavandula* sp.; also found in open coastal areas.

Remarks. All the specimens examined have olive green-blackish colouration, which is characteristic for *S. morsitans scopoliana* C.L. Koch, 1841. However, Lewis (1969, 1978) studied the variation of African scolopendrid centipedes, and particularly that of *S. amazonica* and stated that the colouration show a considerable degree of variation, thus being an unreliable taxonomic character. Koch (1982) observed the same variability in *S. laeta* in Australia, finding some correlation with the rainfall. The darkest forms of *S. laeta* occur mainly in areas with high mean annual rainfall (more than 750 mm), although sometimes they are also found in regions with low rainfall (up to 250 mm). Other characters used to characterize *S. m. scopoliana* are tergal margination starting on tergite 17, and coxopleural process bearing 5 spines (Brolemann 1932). As it has already been shown by Lewis (1969) these are also of little taxonomic value in *S. morsitans* and for this reason *S. morsitans scopoliana* is here considered a junior synonym of *S. morsitans*.

***Cormocephalus gervaisianus* (C.L. Koch, 1841)**

Figs 14-17

Cupipes gervaisianus: Silvestri 1896, Naturalista Siciliano, An. I, (Nuova Serie), 8: 151.

Cupipes gervaisianus: Kraepelin 1903, Mitteilungen aus dem Naturhistorischen Museum in Hamburg, 20: 179, fig. 120.

Cupipes gervaisianus: Attems 1908, Voyage zoologique en Khroumirie (Tunisie), Rouen: 104.

Cupipes gervaisianus: Brolemann 1921, Bulletin de la Société des Sciences Naturelles du Maroc, I (3-6): 104.

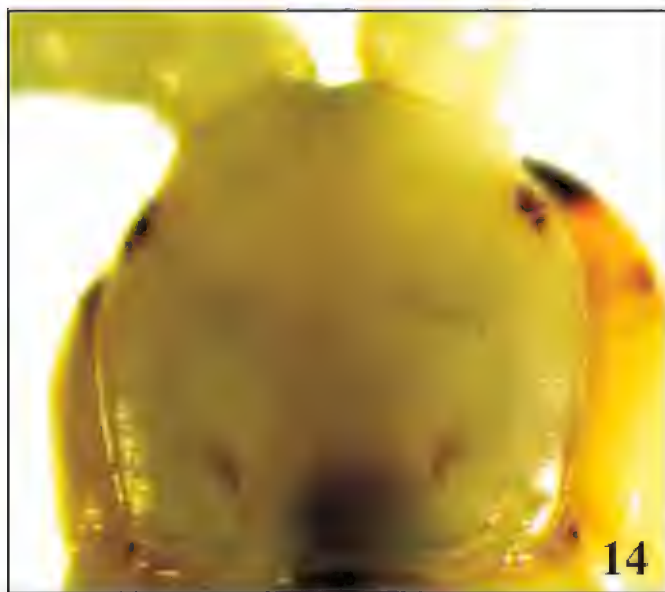
Cormocephalus gervaisianus: Attems 1930, Das Tierreich, 54: 102, figs 121-122.

Cupipes gervaisianus: Brolemann 1932, Bulletin de la Société d'Histoire Naturelle d'Afrique du Nord, 23 (2): 50.

Cormocephalus gervaisianus: Dobroruka 1968, Revue de Zoologie et de Botanique Africaines 78(3-4): 204.

Material examined. 1 ex., Tunis Distr., Faculty of Sciences of Tunis, N36°41.31/ E10°40.20, alt. 81 m, urban area with scattered trees of *Eucalyptus*, *Acacia mimosa* and *Nerium oleander*, 24.9.2003; 3 ex., same locality, 29.9.2003; 3 ex., same locality, 15.10.2003; 1 ex., same locality, January 2004; 2 ex., Beja Distr., Nefza, N36°88/ E9°03, garrigue with *Olea europaea*, *Pistacia lentiscus*, 27.2.2004; 2 juv., same locality, 18.4.2004; 1 juv., same locality, 3.10.2005; 2 ex., Jendouba Distr., Feidja N.P., N36°29.76/ E08°18.36, alt. 746 m, oak forest dominated by *Quercus faginea* with scattered *Q. suber* and a dense underwood of *Erica arborea*, *Phillyrea angustifolia*, *Cystus trifolia* and *Calycotome villosa*, 7.3.2004; 1 ex., Jendouba Distr., Col des Ruines Ain Draham, N36°47.24/ E08°41.02, alt. 799 m, oak forest dominated by *Q. faginea* associated with scattered *Q. suber*, 18.4.2004; 1 ex., Bizerta Distr., Ichkeul

N.P., N37°08.30/ E09°41, alt. 51 m, 7.1.2005; 6 ex., same locality, 8.2.2004; 2 juv., same locality, 24.9.2005; 1 ex., same locality, 3.12.2006; 2 ex., Sousse Distr., Bou Fichta, N36°17.55/ E10°27.30, alt. 6 m, open area with scattered shrubs, 22.3.2005; 1 ex., Ariana Distr., Jebel Ammar, Sidi Thabet, N36°55.05/ E10°04.54, alt. 70 m, maquis with scattered crops of *Olea europaea*, *Callitris articulata* and *Lavandula multifida*, 20.11.2003; 1 ex., same locality, 6.10.2006; 1 ex., Bizerta Distr., Zouaouine, N37°07.49/ E10°04.09, alt. 5 m, 11.1.2004; 1 juv., Tunis Distr., Jebel Rsas, N36°37.22/ E10°20.15, alt. 600 m, 21.9.2005; 1 ex., Le Kef, N36°11.44/ E08°44.39, alt. 831 m, 27.4.2005; 2 ex., Ariana Distr., El Ghazela, N36°53.32/ E10°10.62, alt. 14 m, houses' garden, 13.04.2007; 1 ex., Jendouba Distr., Beni Mtir, 19.2.2007, alt. 500 m; 1 juv., Tunis Distr., Jebel Bou Kornine, 17.2.2004; 3 juv., Zaghuan Distr., Jebel Zaghuan, N36°23.269/ E10°08.157, alt. 352 m, 25.2.2007; 1 ex., Ariana Distr., El Ghazela, house's garden, 20.3.2008; 4 ad., 2 juv., Tunis Distr., Bou Kournine N.P., N36°42.530/ E10°20.680, alt. 105-150 m, *Thuya*, *Eucalyptus*/ dry river bed, under stones and logs, 4.3.2008; 1 ad., 1 juv., Zaghuan Distr., Jebel Zaghuan, surroundings of the Gouffre du Courant d'Air (small limestone cave), N36°21.980/ E10°05.513, alt. 561 m, *Quercus ilex*, *Pistacia lentiscus*, *Jasminum fruticans*, under stones and leaf litter, 17.3.2008; 3 ad., same mountain, surroundings of the marabout Sidi Bou Gabrine, N36°22.423/ E10°06.328, alt. 642 m, meadows, scattered trees, under stones and



Figs 14-17. *Cormocephalus gervaisianus*: 14 – head plate; 15 – forcipular coxosternum and forcipules; 16 – terminal tergite and prefemur of ultimate leg, dorsal view; 17 – prefemur of ultimate leg, ventral view.

leaf litter, 17.3.2008; 1 juv., same locality, 29.3.2008; 1 ex., same mountain, collecting along the track between Gouffre Anti Préhistorique (N36°21.595/ E10°05.208) and Sidi Bou Gabrine (N36°22.423/ E10°06.328), 500-700 m, mixed forest, under stones and leaf litter, 18.3.2008; 3 ad., same mountain, collecting along the track Sidi Bou Gabrine (N36°22.423/ E10°06.328) – Sidi Abdel kader Cave (N36°22.419/ E10°06.371) – Saida Mannoubia (N36°22.650/ E10°06.332) – the asphalt road to Zaghouan (36°22.924/ E 10°06.789), alt. 650-780 m, mixed forest, under stones and leaf litter, 19.3.2008; 5 ad., 4 juv., Beja Distr., 7 km of Zahret Medine, N36°46.857/ E09°01.688, alt. 500 m, limestone hill, shrubs, under stones, 20.3.2008; 1 ad., 1 juv., same district, 13 km of Nefza (road Tabarka-Nefza), N36°57.610/ E08°56.507, alt. 150 m, Pine forest, under stones, 23.3.2008; 2 ad., 3 juv., Jendouba Distr., Tabarka, the Genoese fort and surroundings, N36°57.838/ E08°44.680, alt. 20-30 m, slope facing the sea, grass, rocks scattered trees, under stones and logs, 22.3.2008; 1 ad., same district, Hammam Bourguiba (west of Ain Draham), N36°45.926/ E08°35.084, alt. 158 m, meadow with scattered trees, under stones, 22.3.2008; 2 ad., Cap Bon Peninsula, Nabeul Distr., near Oued El Abid Dam, N36°49.901/ E10°42.378, alt. 42 m, grass, stones, under stones, 24.3.2008; 3 ad., Zaghouan Distr., Jebel Mansour, close to Sidi Aouidet Village, N36°12.307/ E09°45.588, alt. 514 m, Pine forest, *Rosmarinus*, under stones and leaf litter, 28.3.2008.

Description. Colour yellowish to olive-green. Maximal length, including ultimate legs, ca. 60 mm. Head plate with 2 paramedian sutures occupying the posterior half of head plate (Fig. 14). Antennae composed of 17 articles, the basal 6 glabrous. Tooth plate with 3+1 teeth, the lateralmost one well separated from the others. Trochanteroprefemoral process moderately expanded bearing 4 tubercles (Fig. 15). Legs 1-20 with two spurs on tarsus 2. Spiracles small and rounded. Tergites 1-20 with 2 paramedian sulci (those on first tergite not reaching anterior border), tergite 21 with a complete median suture. Sternites 2 to 20 with two complete paramedian sutures which are well separated anteriorly and posteriorly and narrowing in the middle of sternite. Sternite 21 trapeziform, broader anteriorly. Ultimate pair of legs: coxopleuron with one lateral spine and long and slender process bearing 2 terminal spines; pores not reaching posterior border of coxopleura. The length of coxopleural process varies considerably between specimens. Prefemur, femur and tibia strongly swollen with dorsal furrow, tarsus 1 wider than tarsus 2; prefemur with 2 ventrolateral rows of 3-5 spines, and 8-10 ventromedial and medial teeth and 2-6 dorsomedial ones (Figs 16-17). Pretarsus finely serrated ventrally, longer than tarsus 2.

General distribution. Spain, Algeria, Tunisia, Azerbaijan (Minelli 2006)

Distribution in Tunisia (Map 3). Widespread in North and Central Tunisia. The range covers the Mogods-Kroumirie Mts. in the west (Feidja, Beni Mtir) and spreads to the eastern part of the Tunisian Ridge (Jebel Mansour and Jebel Zaghouan) and the main coastal area of the Gulf of Tunis (Bizerta, Tunis, Ariana) including the Cap Bon Peninsula (Oued el Abid). Further south it has been found also in the Sahel (Bou Fichta in the district of Sousse). In the past recorded from Tunis, Souk el Arba, Babouch and Ain Draham (Silvestri 1896, Attems 1908). Dobroruka (1968) reported the species from Savoual (Zaghouan Region) but we were unable to find this locality on the map.

Altitudinal range in Tunisia. Known from sea level up to approx. 800 m.

Habitats. Mixed oak formations dominated by either *Quercus faginea* or *Q. suber*, coniferous forests dominated by *P. halepensis*, mixed forests of *Q. faginea* and *Q. suber*, *Q. faginea* and *Pinus pinaster*, *P. halepensis* and *Quercus ilex*, *Q. coccifera* and *P. halepensis*. It is also found in semidry open areas, garigue with *Olea europaea*, suburban habitats and coastal grasslands.

Remarks. The morphological characters of the specimens examined correspond well with the description of this species given by Attems (1930) which was the most recent description. *Cormocephalus*, which currently comprises about 70 species, was divided into three supergroups, each composed of several species-groups (Schileyko and Stagl 2004). In this tentative division, *C. gervaisianus* belongs to the *gervaisianus* species group of supergroup III, which is characterized by the presence of complete (rarely somewhat shortened) paramedian sulci on tergite 1; paramedian sulci complete from tergite 2; prefemur of ultimate leg-pair usually bearing ventrolateral spines; coxa of terminal legs with well developed coxopleural process; and pretarsus of ultimate legs longer than tarsus 2.

***Otostigma spinicaudus* (Newport, 1844)**

Figs 18-25

Otostigma tunetorum Verhoeff, 1901, Nova Acta Leopoldina, 77: 433, Vergl. Taf. III Abb. 16.

Otostigma spinicaudus: Kraepelin 1903, Mitteilungen aus dem Naturhistorischen Museum in Hamburg, 20: 107, fig. 49.

Otostigma spinicauda: Brolemann 1921, Bulletin de la Société des Sciences Naturelles du Maroc, I (3-6): 104.

Otostigma spinicaudus: Attems 1930, Das Tierreich, 54: 148, fig. 176.

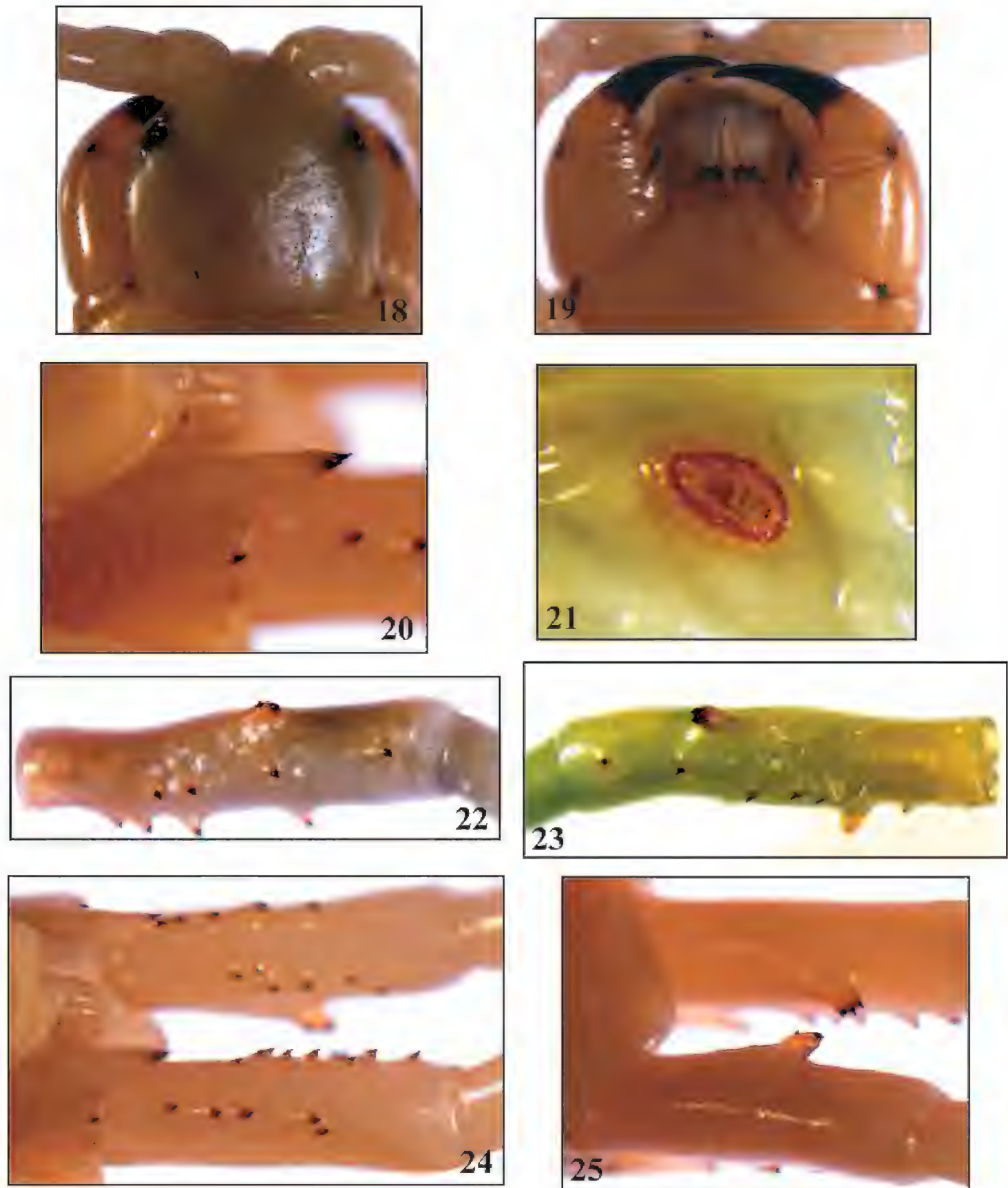
Otostigma spinicaudus: Brolemann 1932, Bulletin de la Société d'Histoire Naturelle d'Afrique du Nord, 23 (2): 51.

Otostigma spinicaudus: Lewis 2000, Journal of Natural History, 34: 434, figs 1-10.

Material examined. 1 ex., Sidi Bouzid Distr., Bou Hedma N.P., N34°30.28/ E09°35.46, alt. 574 m, 20.3.2006; 1 ex., Kasserine Distr., Chambi N.P., surrounding of the park's guest house, N35°10.139/ E08°40.486, alt. 950-1000 m, *Pinus halepensis*, *Stipa tenacissima*, *Thuya* sp., under stones, logs and leaf litter of *Pinus halepensis*, 8.3.2008; 1 ex., Gabes Distr., Matmata, N33°32.450/ E09°59.054, alt. 384 m, arid biotope, shrubs and stones, under stones, 13.3.2008.

General distribution. Known from Morocco, Algeria, Tunisia, Libya and the Spanish islands Fuerteventura and Lanzarote (Canary Isl.); *O. spinicaudus ghiblanus* Manfredi, 1935 and *O. spinicaudus latispinus* Manfredi, 1939 are known only from their type localities in Libya (Minelli 2006).

Distribution in Tunisia (Map 4). Known from Tunis (Verhoeff 1901), the mountains Bou Hedma and Chambi, and the surroundings of Matmata (new records); the specimen from Matmata may be another (sub)species (see below).



Figs 18-25. *Otostigmus spinicaudus*: 18 – head plate; 19 – forcipular coxosternum and forcipules; 20 – coxopleural process, lateral view; 21 – spiracle; 22-23 – prefemur of ultimate legs (specimen from Chambi): left leg, ventromesal view; right leg, mesal views, respectively; 24-25 – prefemora of ultimate legs (specimen from Matmata), ventral and dorsal views, respectively.

Altitudinal range in Tunisia. Known from 950-1000 m.

Habitats. Arid biotopes with *Acacia raddiana* or shrubs; sparse *P. halepensis* and *Thuya* forest grown with *Stipa tenacissima*.

Remarks. Lewis (2000) provided a detailed re-description of *O. spinicaudus* based on material from the Canary Islands. The specimens from Jebel Chambi (Figs 21-23)

and Bou Hedma correspond well with the description given by Lewis, differing only in the number of ventromedial prefemoral spines on ultimate leg (4 vs. 3). In the specimen from Chambi two tarsal spurs are present on leg-pairs 1-9 the rest to 19 have one, while in the Bou Hedma specimen only legs 1-6 have two tarsal spurs. In the Canary Islands specimens there were usually two tarsal spurs on the first four pairs of legs but sometimes they occurred as far as leg-pair 8. Both specimens have coxopleural processes bearing 2 apical, one lateral and one dorsal spine. The dorsomedial conical protuberance bears a single apical spine in the specimen from Bou Hedma and two to four in the specimen from Jebel Chambi (Figs 22-23).

The specimen from Matmata is differing from the other two specimens and from the Lewis' (2000) redescription in that the prefemur of the ultimate leg bears 4-5 ventrolateral and 6-9 ventromedial spines (vs. 3/3 in Canary specimens and 4/4 in other Tunisian specimens), and the conical protuberance bears 4-5 spines (vs. usually 1-2) (Figs 24-25). In all other respects the specimen resembles *O. spinicaudus*.

Manfredi (1935, 1939) described two subspecies of *spinicaudus* from Libya – *O. s. ghiblanus* Manfredi, 1935 and *O. s. latispinus* Manfredi, 1939. The former was separated from nominate form by the presence of incomplete sternal sutures and only 2 apical spines on the coxopleural process, as well as by the different position of the



Map 3. Distribution of *C. gervaisianus* in Tunisia.



Map 4. Distribution of *O. spinicaudus* in Tunisia. The Matmata record is marked with an arrow.

dorsomedial spine on the prefemur of ultimate leg-pair (Manfredi 1935). The subspecies *latispinus*, was distinguished by the size, shape and the position of the dorsomedial prefemoral protuberance of the ultimate pair of legs, which is sited at mid-length of prefemur (big and emerging as a triangular appendix at the median side of the leg, sometimes bent distad, dorsally convex, ventrally concave with an apical spine). The prefemur also has strong longitudinal medial sulcus. Although not specified, the number of ventral prefemoral spines is higher than that in the type (Manfredi 1939). Having a larger number of prefemoral spines and well-developed conical protuberance on the dorsomedial side of the prefemur, the Matmata specimen resembles *O. spinicaudus latispinus*. However, it has 4-5 apical spines on the dorsomedial prefemoral protuberance instead of 1, and lacks a longitudinal sulcus. It could be a distinct (sub) species, although with only one specimen available it could represent an aberrant individual. The irregular arrangement of the prefemoral spines and their elevated number may indicate the ultimate legs are regenerated. Further Tunisian and other material is required in order to clarify the situation.

Family Cryptopidae

Cryptops (Cryptops) trisulcatus Brölemann, 1902

Figs 26-27

Cryptops anomalans: Silvestri 1896, Naturalista Siciliano, An. I, (Nuova Serie), 8: 151. Misidentification?

Cryptops anomalans: Attems 1908, Voyage zoologique en Khroumirie (Tunisie), Rouen: 104. Misidentification?

Cryptops trisulcatus: Brolemann 1932, Bulletin de la Société d'Histoire Naturelle d'Afrique du Nord, 23 (2): 50.

Material examined. 1 ex., Jendouba Distr., Beni Mtir, N36°44.44/ E08°44.52, alt. 500 m, 19.2.2007, alt. 500 m; 1 ex., Nabeul Distr., Soliman, N36°42.54/ E10°21.15, alt. 98 m, 12.11.2006; 1 ex., Jendouba Distr., Ain Draham, Col des ruines, N36°47.24/ E08°41.02, alt. 799 m, 5.2.2004; 1 ex., same locality, 3.10.2005; 1 ex., Beja Distr., Jebel El Jouza Amdoun, N36°50.09/ E09°06.0, alt. 614 m, mixed oak forest, 19.11.2003; 3 ex., same locality, 4.11.2003; 1 ex., Beja Distr., Nefza, N36°45.42/ E09°11.41, alt. 176 m, 27.2.2004; 1 ex., same locality, 18.4.2004; 2 ex., Bizerta Distr., Ichkeul N.P., 8.2.2004; 1 ex., same locality, 7.1.2005; 1 ex., Ariana Distr., Nahli, N36°53.02/ E10°09.14, alt. 75 m, 6.12.2003; 1 ex., Kasserine Distr., inside Chambi N.P., N35°11.901/ E08°39.505, alt. 1291 m, *Pinus halepensis*, *Quercus ilex*, *Stipa tenacissima*, slope, under stones and leaf litter, 9.3.2008; 1 ex., inside Chambi N.P., N35°11.709/ E08°39.309, alt. 1286 m, *Pinus halepensis*, *Quercus ilex*, *Stipa tenacissima*, ruins, under stones and leaf litter, 9.3.2008; 2 ex., Zaghouan Distr., Jebel Zaghouan, surroundings of the marabout Sidi Bou Gabrine, N36°22.423/ E10°06.328, alt. 642 m, meadows, scattered trees, under stones and leaf litter, 17.3.2008; 1 ex., same

locality, 29.3.2008; 1 ex., same mountain, collecting along the track between Gouffre Anti Préhistorique (N36°21.595/ E10°05.208) and Sidi Bou Gabrine (N36°22.423/ E10°06.328), 500-700 m, mixed forest, under stones and leaf litter, 18.3.2008; 1 ex., same mountain, collecting along the track Sidi Bou Gabrine (N36°22.423/ E10°06.328) – Sidi Abdel kader Cave (N36°22.419/ E10°06.371) – Saida Mannoubia (N36°22.650/ E10°06.332) – The asphalt road to Zaghouan (N36°22.924/ E10°06.789), alt. 650-780 m, mixed forest, under stones and leaf litter, 19.3.2008; 1 ex., Beja Distr., 7 km of Zahret Medine, N36°46.857/ E09°01.688, alt. 500 m, limestone hill, shrubs, under stones, 20.3.2008; 1 ex., Jendouba Distr., 4 km of Tabarka (direction of Malloula), N36°57.476/ E08°43.781, alt. 225 m, *Eucalyptus* and pine forest, under stones, 22.3.2008; 7 ex., Zaghouan Distr., Jebel Mansour, close to Sidi Aouidet Village, N36°12.307/ E09°45.588, alt. 514 m, Pine forest, *Rosmarinus*, under stones and leaf litter, 28.3.2008.

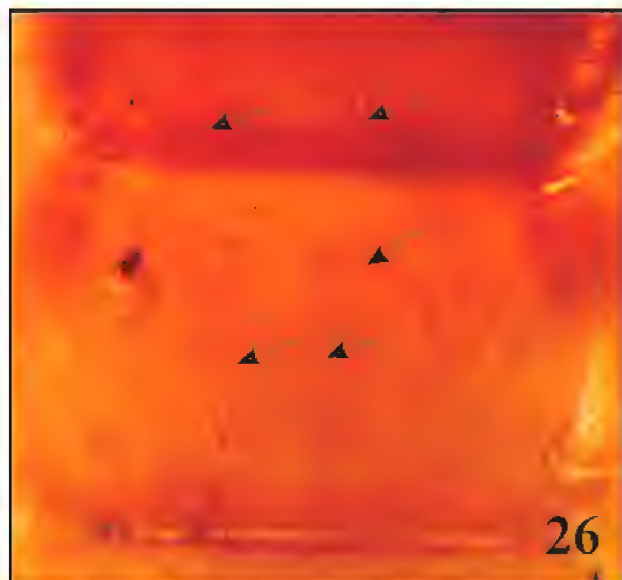
General distribution. Canary Islands, Algeria, Tunisia, Maltese Archipelago, Portugal, Spain (incl. Balearic Islands), South of France (incl. Corsica), Italy (incl. Sicily, Sardinia), Romania, Insular Greece (Ionian, Dodecanese islands and Crete), SE Turkey (Zapparoli 2002, Zapparoli et al. 2004).

Distribution in Tunisia (Map 5). Known from the Humid to Semiarid bioclimatic zones. The species range covers a vast area starting from the Mogods-Kroumirie region in the West and parts of the Tunisian Ridge chain further South (e.g. Chambi N.P.) and ending in Jebel Mansour, Jebel Zaghouan, the Gulf of Tunis and Cap Bon Peninsula (Soliman) area in the northeast. Known also from Ichkeul N.P.

Altitudinal range in Tunisia. Known from approx. 200 up to approx. 1300 m.

Habitats. Forests of *Quercus faginea*, mixed woods of *Q. faginea* and *Q. suber*, *Q. coccifera* and *P. halepensis*; *P. halepensis* and *Q. ilex*; found also in heterogenous *Eucalyptus* forest.

Remarks. Although this widespread Mediterranean species has already been recorded from Algeria (Ribaut 1915) and from the neighbouring Italian island of Pantelleria situated approx. 70 km off the Tunisian coast (Zapparoli 1995), these are the



Figs 26-27. *Cryptops trisulcatus*: 26 – posterior part of head plate and tergite 1; 27 – coxosternum.

first definite records of *C. trisulcatus* in Tunisia (see also under Discussion). Brolemann (1932) summarized the distribution of *C. trisulcatus* as “Littoral méditerranéen d’Afrique et d’Europe”. It remains unclear whether this general statement was supported with original data from Tunisia. The species is also known from the Maltese Archipelago (Zapparoli et al. 2004). In several places, like Jebel Zaghouan, Jebel Mansour, Jebel Chambi, *C. trisulcatus* is fairly common and occurs syntopically with *C. punicus*.

***Cryptops (Cryptops) punicus* Silvestri, 1896**

Figs 28-30

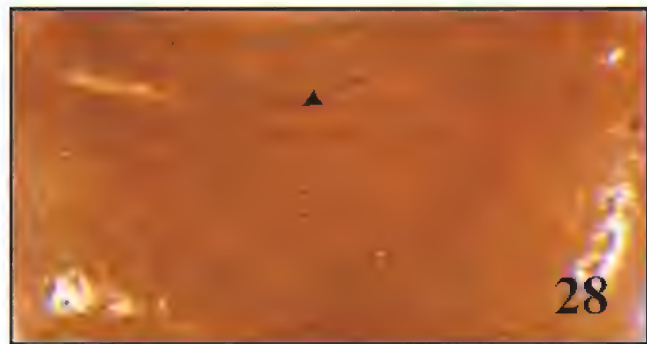
Cryptops anomalans Newport, v. n. *punicus* Silvestri, 1896, Naturalista Siciliano, An. I (Nuova Serie), 8: 151.

Cryptops anomalans punicus: Brolemann 1921, Bulletin de Société des Sciences Naturelles du Maroc, I (3-6): 104.

Trigonocryptops punicus: Brolemann 1928, Bulletin de la Société d’Histoire Naturelle de Toulouse, 57: 257, figs 10-18.

Trigonocryptops punicus: Brolemann 1932, Bulletin de la Société d’Histoire Naturelle d’Afrique du Nord, 23 (2): 48-49.

Material examined. TUNISIA: 3 ex., Nabeul Distr., Soliman, N 36°42.54/ E10°21.15, alt. 98 m, 12.11.2006; 2 ex., Ariana Distr., Sidi Thabet, N36°55.05/ E10°04.54, alt. 70 m, 20.11.2003; 1 ex. Mahdia Distr., Chebba, 20.3.2004; 1 ex., Le Kef, N36°11.44/ E08°44.39, alt. 623 m, 24.10.2003; 5 ex., Bizerta Distr., La Grotte Beach, N37°19.56/ E09°51.30, alt. 39 m, 12.2.2004; 1 ex., Sousse Distr., Bou Fichta, N36°17.55/ E10°27.30, alt. 6 m, 22.3.2005; 4 ex., Zaghouan Distr., Jebel Zaghouan, N36°23.269 / E10°08.157, alt. 352 m, 25.2.2007; 1 ex., Gabes Distr., Chenini Oasis, 22.3.2006; 1 ex., Ariana Distr., Sidi Thabet, 17.3.2004; 1 ex., Kasserine Distr., Chambi N.P., surrounding of the park’s guest house, N35°10.139/ E08°40.486, alt. 950-1000 m, *Pinus halepensis*, *Stipa tenacissima*, *Thuya*, under stones, logs and leaf litter of *Pinus halepensis*, 8.3.2008; 2 ex., Gabes Distr., Matmata, N33°32.450/ E09°59.054, alt. 384 m, arid biotope, shrubs and stones, under stones, 12.3.2008; 2 ex., Mahdia Distr., Mahdia City, Touristic area, N35°32.796/ E11°01.662, alt. 0 m, scattered palm trees and shrubs close to the road, polluted area not far from agricultural land, under stones, 16.3.2008; 2 ex., Zaghouan Distr., Jebel Zaghouan, surroundings of the Gouffre du Courant d’Air (small limestone cave), N36°21.980/ E10°05.513, alt. 561 m, *Quercus ilex*, *Pistacia lentiscus*, *Jasminum fruticans*, under stones and leaf litter, 17.3.2008; 1 ex., same mountain, surroundings of the marabout Sidi Bou Gabrine, N36°22.423/ E10°06.328, alt. 642 m, meadows, scattered trees, under stones and leaf litter, 17.3.2008; 1 ex., Jendouba Distr., Tabarka, the Genoese fort and surroundings, N36°57.838/ E08°44.680, alt. 7 m, sea shore, 10-40 m from the water line, logs, grass, under stones, 22.3.2008; 1 ex., Nabeul Distr., Cap Bon Peninsula, Kelibia, the fort and surroundings, N36°50.337/ E11°06.841, alt. 10-40 m, slope, *Eucalyptus*, *Mimosa*, shrubs, under stones, 25.3.2008; 3 ex., same area, 7 km of Menzel Bou Zelfa, N36°40.268/ E10°40.677, alt. 236 m, *Pinus*, *Quercus*, shrubs,



Figs 28-31. *Cryptops punicus*: 28 – tergite 1; 29 – coxosternum; 30 – labral tooth; 31 – tibia and tarsus of ultimate leg. Arrows on figures 26 and 28 indicate the tergal sutures.

under stones, 25.3.2008; 1 ex., Siliana Distr., Jebel Bargou, 5 km of Bargou (road Bargou – Oueslatia), N36°05.775/ E09°37.347, alt. 571 m, *Quercus*, *Olea*, shrubs, under stones, 28.3.2008; 5 ex., Zaghouan Distr., Jebel Mansour, close to Sidi Aouidet Village, N36°12.307/ E09°45.588, alt. 514 m, Pine forest, *Rosmarinus*, under stones and leaf litter, 28.3.2008. LIBYA: 1 ex., Tripoli, 0-20 m, 28-30.11.1999, P. Beron leg.

Description. Light brown to tawny with dense punctuation, and extensive setation. Maximal length: 22-28 mm. Head as long as broad, with 2 short paramedian longitudinal sutures on the anterior and posterior borders of head plate. Antenna composed of 17 articles. Coxosternum rounded and slightly prominent (Fig. 29). Labrum with a single tooth (Fig. 30). First tergite with a complete curved anterior transverse suture only (Fig. 28). Paramedian sutures incomplete on the second tergite, becoming complete from the third. Lateral crescentic sulci starting on the 3rd or 4th tergite. From third leg-pair onwards tarsus 1 and tarsus 2 faintly separated. Ultimate pair of legs: coxopleura with pore field extending to but not touching the posterior margin of coxa. Many scattered setae among the pores and a tuft of 7-8 posterior to the pore field. Tibial saw with 11-13 sharp teeth. Tarsal saw with 5-7 teeth (Fig. 31).

General distribution. Algeria, Tunisia, Libya and Italy: Sicily, Sardinia, Tuscan Archipelago (Matic 1962, Minelli 1982, Zapparoli 1995).

Distribution in Tunisia (Map 6). One of the most common scolopendromorphs in Tunisia found in all bioclimatic zones. Originally described from Tunis (Silvestri 1896), it is currently known also from the littoral of Kroumirie (Tabarka), from the Gulf of Tunis area and along the eastern part of the Tunisian Ridge up to the Cap Bon Peninsula (Soliman, Mensel Bou Zelfa). Towards the centre, it is present in the western mountains of the Ridge (Chambi N.P.) and along the eastern coast of the Sahel (Sousse, Mahdia, Chebba) down to the plain of Jeffara in the southeast (Matmata, Gabes).

Altitudinal range in Tunisia. Known from sea level up to 1000 m in the mountains (Jebel Chambi).

Habitats. Forests dominated by *Q. coccifera* or *Pinus halepensis*, mixed woods of *Q. ilex* and *P. halepensis* or *Q. coccifera* and *P. halepensis*, mountain meadows, suburban areas, oases, arid rocky terrains with scattered shrubs.

Remarks. Silvestri (1896) described *Cryptops punicus* from Kroumirie as a variety of *C. punctatus* (now *anomalous*). It was synonymised with *C. anomalous* by Kraepelin (1903) and later revived by Brolemann (1928). Besides raising *punicus* to full species rank, Brolemann also transferred it to the genus *Trigonocryptops*, which is currently considered a subgenus of *Cryptops* Leach, 1815. *Trigonocryptops* is characterised by trigonal sutures in front of the endosternite, a transverse ridge on the sternites between the coxae, generally bipartite tarsi, head overlying tergite 1, a transverse suture on tergite



Map 5. Distribution of *C. trisulcatus* in Tunisia.



Map 6. Distribution of *C. punicus* in Tunisia.

1, a divided katopleure and mostly yellow or brown colour. Other characters shared by members of *Trigonocryptops* are an anterior setose area on the clypeus delimited by sutures, paired spinose process on the ultimate leg, slit-like spiracles, etc. (Edgecombe 2005). *C. punicus* shows some of the characters typical for *Trigonocryptops*, e.g. subdivided tarsi (very faint in most specimens), yellowish colouration, head overlying tergite 1, transverse suture on tergite 1 but these are shared with some species of the subgenus *Cryptops*. Instead of trigonal sutures at the base of endosternite there is just a curved transverse suture (see Brolemann 1928, fig. 14). With this possible exception *C. punicus* lacks the characters unique to the subgenus *Trigonocryptops* viz. the clypeus is devoid of sutures, and ultimate leg is devoid of processes. The spiracles are ovoid-shaped and the katopleure is single. For the above reasons, we prefer to place *C. punicus* in the subgenus *Cryptops* rather than in *Trigonocryptops* as suggested by Brolemann (1928). Nevertheless, until combined morphological and molecular phylogenetic analysis is undertaken in the genus *Cryptops*, the real position of *C. punicus* remains uncertain. The specimen from Tripoli represents the first formal record of the species from Libya.

Discussion

Remarks on the occurrence of *Scolopendra cingulata*, *S. oraniensis* and *C. anomalans* in Tunisia

Scolopendra cingulata, *S. oraniensis* and *C. anomalans* were reported for Tunisia in several old publications but were not found in the recently collected material. While those of *S. oraniensis* (e.g. Silvestri 1896, Brölemann, 1904) are most likely due to misidentification with the closely related *S. canidens* (see also Würmli 1980), the presence of the other two species requires further explanation in the light of the new study. *S. cingulata* was reported for all the countries of the Maghreb region in Brolemann's checklist of North African myriapods (1921). This publication still serves as a main source of information regarding the North African myriapod fauna, being cited even nowadays in papers outlining the world distribution of *S. cingulata* (e.g. Zapparoli 2002, Zapparoli et al. 2004, and Simaiakis and Mylonas 2008). It seems that Brolemann's data originated from Kraepelin's (1903) general statement that *S. cingulata* is distributed "durch ganz Nordafrika" [throughout northern Africa], though the author did not list exact localities to support this. There are numerous later records of *S. cingulata* from one or another country in the Maghreb (e.g. Verhoeff 1908, Manfredi 1939, Brolemann 1947), and the species was also reported to occur on the closely situated to Tunisia islands Pantelleria and Lampedusa (Zapparoli 1995). However, until new material becomes available to confirm its presence in Tunisia, we regard the old records as dubious. So far, the only reliable records of *S. cingulata* in North Africa come from the eastern part of Egypt (Lewis 1985, Minelli 2006).

Cryptops anomalans was recorded by Silvestri (1896) from Souk el Arba, Ain Draham and Babouch, and by Attems (1908) from Ain Draham. The recent intensive collecting in the region of Ain Draham where all these localities are situated did not

confirm its presence there. Instead, another species, *C. trisulcatus*, appeared to be quite common in the area. Taking into account that *C. trisulcatus* superficially resembles *C. anomalans* (both having identical number of saw teeth on ultimate leg-pair and tergite 1 having obvious sutures), and the fact that at the time when Silvestri reported *anomalans*, *C. trisulcatus* had not been described, it is very probable that Silvestri misidentified his material. This may also holds true for Attems' later record of *anomalans*.

Distribution patterns

The scolopendromorph centipedes are widely distributed in Tunisia and occur in all the bioclimatic zones – from the humid and subhumid forests in the northwestern part of the country to the pure sandy deserts in the south. *Cryptops punicus* and *S. canidens* are the most common species, and except for the extreme south are virtually distributed throughout the country. The notable absence of *S. canidens* from the Kroumirie region and the core of Cap Bon Peninsula, could be explained by the higher humidity in those areas and possible competition with *S. morsitans*. The recent finds of *S. canidens* from Ksar Oued Soltane and Douiret (both situated south of Tatauine) constitute the southernmost point of distribution of Scolopendromorpha in Tunisia and together with still unidentified specimen of Lithobiidae represent the southernmost record of Myriapoda as a whole. The records from the Hoggar (Ahaggar Mts., Southern Algeria) represent the southernmost records of *S. canidens* in Africa (Würmli 1980).

S. morsitans has a restricted distribution in northeastern Tunisia from the extreme northern parts of Cap Bon Peninsula to the surroundings of Siliana. It seems that *S. canidens* and *S. morsitans* occur allopatrically in the country, the latter being generally restricted to more humid parts, the former to the rest of the country, including the harsh deserts in the south, southern coastal regions, and the islands of Djerba and Kerkennah. The eastern part of Tunisian Ridge is a possible contact zone where they may occur together. *Cryptops trisulcatus* and *Cormocephalus gervaisianus* show an almost identical distribution in north and central Tunisia, with the exception that the former goes farther south reaching the Chambi N.P. *Cryptops trisulcatus* is absent from the Cap Bon Peninsula although it is found along the coast to the west of that area. *O. spinicaudus* is the rarest of all the six species. Until now it was known only from Tunis, while the freshly collected material comes from three localities lying well apart from each other in the central and southeastern parts of the country.

Habitat preferences

In Tunisia, scolopendromorphs are known from virtually all the main types of vegetation, starting with the humid and subhumid oak forests of *Quercus faginea* and *Q. suber* in the Kroumirie-Mogods Mts., passing through the subhumid coniferous forests of the Tunisian Ridge and ending in the pure sandy desert of Sahara. They are also known

in suburban and urban areas, in close proximity to the littoral zone and in agricultural stands. Caves are a largely unexplored biotope in terms of scolopendromorphs. It is not improbable that cave-dwelling species will be found in future in such a large limestone massifs as Jebel Zaghouan.

Cryptops punicus is a eurytopic species, which occurs in forests (oak, pine, eucalyptus, etc.), coastal areas, open grasslands, oases, agricultural stands and arid rocky areas with scattered shrubs. *S. canidens* is also quite euryecious, absent only in the oak forests of Kroumirie. It was found in oak forests dominated by *Q. ilex* (Jebel Bargou, Makthar) or *Q. coccifera* (Jebel Chambi); coniferous forests of *P. halepensis* (Le Kef) and heterogeneous woods with *Q. ilex* and *P. halepensis*; semidry areas dominated by *Acacia raddiana* (Bou Hedma N.P.); coastal areas with sparse shrubs and semihumid grasslands; dry grasslands; dry rocky hills (Jebel Bou Ramli, Gafsa); pure sandy deserts (Douz); suburban areas (e.g. Tataouine and Mahdia cities); agricultural lands; *Olea europaea* stands (the Sahel); oases dominated by *Phoenix dactylifera* (Kebili). *S. canidens* is the only myriapod species in Tunisia recorded in pure sandy desert. Having studied material from Israel, Negrea (1997) concluded that “*S. canidens* is a thermophilous, eurythermic and xerophilous species, occurring on low altitudes (-370 m at 'En Gedi)” and “come from sites....Judean Hills, Judean Desert, Dead Sea, central Negev, and Arava Valley, the most arid parts within the investigated area”.

Like the preceding species, *Otostigmus spinicaudus* is also a thermophilic species. It was found under stones in arid and semidesert biotopes with *Acacia raddiana* (Bou Hedma N.P.) and shrubs (Matmata). In Jebel Chambi it was collected in a sparse *P. halepensis* and *Thuya* forest grown with *Stipa tenacissima*. Lewis (2000) reported it from a crater on Lanzarote. *Scolopendra morsitans* has hitherto been registered only in coniferous forests of *Pinus halepensis*, mixed woods of *Quercus coccifera* and *Rosmarinus officinalis* and in open coastal areas. *Cormocephalus gervaisianus* and *C. trisulcatus* show an affinity to the forest biotopes, being often present in old oak formations and different kinds of mixed heterogeneous woods.

Key for identification of the scolopendromorph centipedes of Tunisia

- 1(2) with 4 ocelli on each side of cephalic plate (Family Scolopendridae) 3
- 2(1) Head without ocelli. Ultimate legs with saw teeth on tibia and tarsus 1 (Family Cryptopidae) 9
- 3(4) Legs without tarsal spurs, pretarsus of ultimate leg longer than tarsus 2, spiracles very small..... *Cormocephalus gervaisianus*
- 4(3) Most legs with tarsal spurs, pretarsus of ultimate leg markedly shorter than tarsus 5
- 5(6) First spiracle (of leg-bearing segment 3) oval (Fig. 21), the rest round.....
..... *Otostigmus spinicaudus*
- 6(5) Spiracles triangular (Fig. 4), more or less parallel to body axis 7

- 7(8) Leg 1 with two tarsal spurs (Fig. 3); coxopleural process generally long, with at least six spines sited laterally as well as distally (Fig. 5); prefemur of ultimate leg with two rows of spines ventrolaterally and two ventromedially (Fig. 7)
*S. canidens*
- 8(7) Leg 1 with one tarsal spur (Fig. 10); coxopleural process short, with at most five distal spines, none laterally (Fig. 11); prefemur of ultimate leg with, at most, three rows of three spines ventrally (Fig. 13); femur and sometimes tibia in males flattened with ridged lateral and median edges*S. morsitans*
- 9(10) Tergite 1 with anterior transverse suture from which run two diverging sutures to the posterior border of the tergite (Fig. 26) *C. trisulcatus*
- 10(9) Tergite 1 with anterior transverse suture only (Fig. 28)..... *C. punicus*

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